borealis on the evenings of April 1 and 2. On April 1 it was first noticed at $8^h\ 49^m$, when an intense auroral glow pervaded the N. sky and gave an effect similar to moonrise. At $8^h\ 51^m$ a broad streamer became visible, reaching a height of 11°. This streamer was situated 2° N. of β Cassiopeiæ, and appeared to be connected with an auroral arch under Cassiopeia, running from N.W. to N. On the following evening, April 2, the auroral light was again intense in due N.

THE additions to the Zoological Society's Gardens during the last week include a Bacha Eagle (*Spilornis bacha*) from Malacca, presented by Mr. W. Jamrach; a Madagascar Porphyrio (*Porphyrio Madagascariensis*) from Madagascar, presented by Miss Furlonger; a Cuttle-fish (*Octopus vulgaris*) presented by the Brighton Aquarium Co.; a great grey Shrike (*Lanius excubitor*) presented by Mr. Hawkins; a Crested Pelican (*Pelecanus crispus*) from S. Europe, presented by Dr. Doyle; a Vulpine Phalanger (*Phalangista vulpina*); a great Kangaroo (*Macropus giganteus*); a yellow-footed rock kangaroo (*Petrogale xanthopus*); and some Tibetan Wolves (*Canis laniger*) born in the Gardens; two Hunting Crows (*Cissa venatoria*) from India; a Cocoi Heron (*Ardea cocoi*) from the W. Indies; a Broad-banded Armadillo (*Xenurus unicinctus*) from Brazil; two Rock Whiting; a Whiting Pout, two Lump-fish, and six Bream all purchased.

ON AN AIR-BATTERY[*]

THIS battery is founded on a reaction, brought by the authors before the Royal Society[†] last spring, in which it was shown that if pieces of copper and silver, in contact, were immersed in copper nitrate solution in presence of oxygen, a deposit of cuprous oxide took place on the silver plate with a corresponding solution of the copper plate, resulting from the decomposition of the copper nitrate in the manner shown in the following formulæ:—

Before contact is made

$$m\mathrm{Ag} \mid \mathrm{O} \mid \mathrm{Cu2NO_3} \mid \mathrm{Cu2NO_3} \mid n\mathrm{Cu}$$

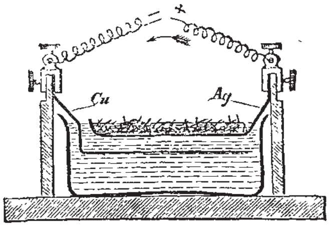
After contact

$$m\mathrm{Ag} \mid \mathrm{Cu_2O} \mid \mathrm{Cu2NO_3} \mid \mathrm{Cu2NO_3} \mid (n-2)\mathrm{Cu}$$

It is evident that this action is continuous until either the copper or the oxygen is exhausted.

It was stated in that paper, that a galvanic current passed through the solution from the copper to the silver, and also that this was only one case of a large class of similar reactions.

The battery takes the form of a shallow circular vessel containing the solution, and the plates are arranged horizontally, the silver plate being at the surface. It will be apparent on glancing at the above equations, that the combination of the oxygen only takes place in the neighbourhood of the silver; hence it was evidently desirable to increase as much as possible the proximity of the silver plate to the air, and also the surface exposed by the silver. This was accomplished as shown in the adjoining sketch. The silver has the form of a shallow tray, full of crystals of silver, and perforated to allow the circulation of the copper solution. The tray is arranged so that the crystals should just rise above the surface, and being, of course, always wet, they very much increase the absorbing surface of the liquid.



The whole arrangement is put upon a wooden stand, and the plates are attached to two uprights fixed in the stand.

The strength of the copper nitrate solution is 6 per cent. This gives about the maximum of effect; a 24 per cent solution gives only half the current; and a 30 per cent solution gives two-thirds. A solution stronger than 6 per cent. is also apt to produce a deposit of subnitrate instead of suboxide.

The best proportionate areas of the silver and copper-plates was investigated in two series of experiments, in one of which the silver remained the same, while the copper surface was diminished by varnishing, and in the other set the copper remained the same while the silver was diminished. The following table gives the results in the latter case. The deflections are those of a Thomson's galvanometer:—

Proportion of Surfaces		Deflection.		
Copper	Silver.	Expt. 1.	Expt. 2.	Expt. 3.
1	0·25	—	—	7°·5
1	0·5	—	—	16°·0
1	0·75	—	—	21°·0
1	1·0	33°	32°	28°·0
1	1·33	41°	40°	—
1	2·0	56°	54°	—
1	4·0	96°	92°	—

It thus appears that an increase in area of the silver plates causes a proportionate increase in the current. It was also found that heat greatly increases the activity of this cell, a cell giving a deflection of 40 at 20° C., gave one of 250 at 50° C.; and the increase in the higher degrees of this range of temperature was much greater than in the lower.

From the nature of the reaction it might be expected that the current would gradually diminish on account of the using up of the oxygen in the neighbourhood of the silver. Such a diminution always does take place at first—agitating the liquid ought, under these circumstances, to increase the action. It does so.

It might also be expected that upon breaking contact for some time, so as to allow oxygen to diffuse itself from other parts of the solution, the current upon again making contact would be as strong, or nearly so, as before. This also was found to be the case.

An experiment was made by putting a cell, with plates connected by a wire, under a bell-jar full of air over mercury. It was expected that the mercury would rise inside the jar from absorption of the oxygen. The mercury did rise, and the oxygen was so completely removed that a lighted taper was immediately extinguished in the remaining gas. The apparatus used in this experiment was exhibited to the Royal Society.

Comparative experiments were made with aerated and de-aërated copper nitrate solution. It was found that the amount of action in the latter case was little or nothing, and what small action there was was clearly attributable to the difficulty of completely excluding air.

Two experiments were made alike in all respects, except that in one case the cell used was filled with a solution simply deprived of oxygen, while the other cell was filled with a solution through which a current of CO_2 was passed for some time. The first was placed in the air, and gave a deflection of 110 rising to 115, but the second was placed in a vessel full of carbonic acid gas, and gave a deflection of 20, which gradually fell to 3.

It was proved experimentally that the cuprous oxide deposited on the silver was compensated by an equivalent solution of the copper plate. The cuprous oxide is sometimes deposited in crystals visible to the naked eye, and shown by a lens to be regular octahedra.

One cell having plates two inches in diameter was found sufficient to decompose such metallic salts as the nitrates of copper, silver, and lead, platinum being used for the negative electrode, and for the positive the same metal as existed in the salt experimented on. Six cells were sufficient to decompose dilute sulphuric acid and dilute hydrochloric acid pretty quickly, copper electrodes being employed.

The theoretical interest of this battery lies in the fact that it differs from all other galvanic arrangements, inasmuch as the binary compound in solution is incapable of being decomposed

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[*] Abstract of paper read at the Royal Society, Thursday, April 3, by J. H. Gladstone, Ph.D., F.R.S., and Alfred Tribe, F.R.S.

[†] Proc. Roy. Soc. vol. 20, p. 290.

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either by the positive metal alone or by the two metals in conjunction, without the presence of another body ready to combine with one of its elements when let free.

Grove's gas battery is essentially different from this, if the oxygen and hydrogen condensed on the platinum plates play the part of the two metals; but it closely resembles this if hydrogen acts the part of the positive metal, and platinum that of the negative; the dilute sulphuric acid will then be decomposed on account of the simultaneous presence of the oxygen which can combine with the liberated hydrogen. Viewed in this manner, Grove's gas-battery is only a special case of the reaction mentioned in the communication to the Royal Society, and the formulæ will be—

Before contact—

$$m\,Pt \mid O. \mid H_2SO_4 \mid n\,H$$

After contact—

$$m\,Pt \mid H_2O \mid H_2SO_4 \mid (n-2)\,H.$$

The practical interest of this arrangement lies in the fact that it is an approximation towards a constant air-battery. Should it ever come into use it would, of course, not be in the form described in this paper, but probably in a combination of copper and zinc, with an aërated solution of zinc chloride, which has an electro-motive force six times that of the silver-copper cell, and three quarters that of a Daniell's cell. Chloride of zinc is preferable to the sulphate, as it offers less internal resistance, and a solution of 20 per cent. is about the best conductor. A single cell of this kind decomposes dilute sulphuric or hydrochloric acid, with copper electrodes.

The power is thus obtained at a minimum of expense, for the oxygen which combines with the zinc costs nothing.

Such a battery would appear to be specially applicable to cases where the galvanic current has to be frequently broken, as in telegraphy, for, at each period of rest, it renews its strength by the absorption or diffusion of more oxygen from the surrounding air.

SCIENTIFIC SERIALS

Zeitschrift für Ethnologie.—The second number of this journal for 1872 scarcely possesses the same scientific value as former numbers. We have, first, the concluding part of Dr. E. von Martens' lecture, read before the Anthropological Society of Berlin, December 1871, on the different uses of the Conchylia. The paper is characterised by true Germanic exhaustiveness, but it indicates a want of appreciation on the part of the author of the relative value of authorities, ambiguous allusions in Longfellow's "Hiawatha" being adduced as evidence, side by side with the statements of scientific travellers. Dr. Martens passes in review every use to which shells have been put in ancient or modern times, and in civilised or uncivilised countries.—Dr. Robert Hartmann continues his notice of the remains found in the Lake Dwellings of Switzerland, and draws attention to the absence of the domestic cat from the more ancient fauna of Europe. The most numerous animal remains belong to the common European stag (*Cervus elephas*), but are of colossal size, and so nearly akin to *Cervus Canadensis* as to raise the question whether the *C. elephas* of the Swiss Lake deposits may not be identical with *C. canadensis.* No trace of reindeer has been discovered, although that animal was common in Switzerland during the glacial period.

In the third number (1872) of the journal, we have an interesting report of the remains of pile dwellings in the Archipelago of North Celebes, which have been examined by the Dutch "Assistant Resident," J. G. F. Riedel. The paper is illustrated with drawings of these huts, and of the different types of head most commonly observed among the North Celebes tribes in the present day. It would appear that the Aborigines were not lake-dwellers. The Toun Singals, however, who were of foreign origin, and arrived in the country between the 12th and 13th centuries, although they at first dwelt on the strand of the present Negeri Atep, soon left their original settlements, and built themselves pile-huts on the great Minahasa Lake, where they were secure from the pursuit of the robber tribes of Djailolo, whose incessant attacks had been the chief incentive to their immigration. The remains of these lake-dwellings give evidence of their solidity, for Herr Riedal found that the piles were for the most part 3 ft. in diameter, and 20 ft. in height above the surface of the lake; the length of each hut was nearly 70 ft., and the breadth 40 ft. Among other events the enforced conversion to Christianity of the Toun Singals in 1830 has separated them still more from the habits of their race, and the memory of the older pile-dwellings seems to be fast dying out among them.

Dr. Bastian gives us in the third number a very complete and carefully elaborated paper on Comparative Philology. He begins by treating of the physiological formation of speech; and of the widely differing groups of emotions which respectively find exression in vocals and in consonants. He passes in review the various nations, whose original language exhibits a preponderance of either of these distinctive characters. Among the older races of America and Africa consonants largely predominate, while in the Malay Polynesian dialects vocal sounds are strongly in the ascendent. The phonetic character of a language influences its grammatic peculiarities.

Herr Rade, who has spent eight years in endeavouring to discover among the Kaukasian tribes some fixed type of their nation, finds from his prolonged investigation of living and dead skulls that the mingling of races has been so continuous in these regions, that it is impossible any longer to recognise the "Kaukasian Race" as it was defined by Blumenbach. Herr Rade has hitherto failed in detecting certain evidence of the existence of Lacustrine dwellings in any of the Kaukasian lakes which he examined.

Dr. Virchow, at a recent special meeting of the Anthropological Society of Berlin, read an interesting paper on the results of a series of explorations made by himself and his sons in the course of last year in the little island of Wollin, lying off Pomerania, in the Baltic. Wollin or Julin as the locality in which the sea-kings or Vikingar had established their once formidable republican settlement of Jomsburg, has always presented special features of interest for Northern inquirers and historians. The early chroniclers of Northern Germany and Scandinavia make frequent allusion to the enormous wealth and great importance of the trading ports of this small island. After ages of decay and desertion the island is again acquiring some slight amount of recognition through the recent establishment of baths near the little town of Wollin. It is here that Dr. Virchow and his sons found unmistakeable evidences of the early existence of a large and wide-spread population. Near the little lake of Vietzig, under a surface of loam or clay-mud, Dr. Virchow came upon a bed of *débris* from 4 to 7 ft in depth, which was entirely formed of fish and animal bones, broken vessels, and all the ordinary adjuncts of the Kjokkenmöddinge as they have been revealed in the Lacustrine deposits of Pomerania. At some places where the hills have been cut, the exposed surfaces seem composed almost entirely of the scales and bones of fishes and other animal remains. At one spot, on the S.E. of the present town, a burying ground was discovered, on which 60 grave-hillocks could still be counted. On penetrating below the surface a heap of burnt and fractured bones was found at a depth of 18 to 20 in., but in no grave, explored by Dr. Virchow, was any trace of urn, stones, or textile fragment to be seen; although remains of fused bronze were met with. A small grant of money has been made by the Society for the purpose of continuing the exploration of the island, and if the work should be placed under the direction of Dr. Virchow we may anticipate valuable results from a more systematic investigation of this site of the most formidable piratical republic ever founded in Northern Europe.

In a paper laid before the Societé d'Anthropologie de Paris by M. Broca, on the Toulouse form of narrow or flat-head deformities, the author enters at length into the consideration of the probable effect on the cerebral functions produced by the ligatures, with which the peasant mothers of some parts of south-west France still compress their children's heads.

THE *Zoologist* for April, after a reprint from the *American Naturalist* of Prof. N. S. Shaler's paper, "Notes on the Right and Sperm Whales;" and ornithological notes from Lincolnshire and Devon, enters further into the discussion of Dr. Baldamus' theory as regards the cuckoos' egg. Mr. Hewitson replies sharply to Mr. Smith's paper in the preceding number; Mr. G. D. Rowley opposes the theory, and thinks that "birds are only too glad to sit on cuckoos' eggs," as they will sit on nothing rather than not incubate. Mr. Doubleday writes to the same effect, as does also Prof. Newton in a quotation from the *Field.* Mr. Smith acknowledges that in writing his former letter, he had not seen Prof. Newton's article on the subject in NATURE (vol. iii. Nov. 1869), but still maintains that British

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